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Social inequalities in attaining higher education in Scotland: New evidence from sibling data

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Over the last decades, various policies at national and local levels have been implemented to widen participation in higher education (HE) in Scotland and more widely in the UK. Despite this, the acquisition of a HE qualification is still largely determined by the family in which individuals are born. Our study provides new evidence on the extent to which family factors matter by examining sibling data from the Scottish Longitudinal Study, a large-scale linkage study created using data from administrative and statistical sources. Random effects linear probability models are used to analyse individual and family-level variance in the chances of obtaining a HE qualification. Our results show that about 40% of the variation in the chances of attaining a university degree is explained by siblings' shared family characteristics and about a third of this share is explained by parental social class, education and housing tenure. A high degree of sibling similarity in the outcome was found across all social-origin classes. However, while siblings of advantaged families are alike because they both graduated from HE, siblings of disadvantaged families are alike because neither of them did. We suggest that parental compensatory strategies in the former families and economic constraints in the latter families may explain such stark patterns of inequality. Finally, we do not find evidence that the availability of sub-degrees makes a difference to these patterns.

Keywords: administrative data; higher education; sibling design; social inequalities

Introduction

Reducing inequalities in access to higher education (HE) is a key policy priority in the UK and beyond. The huge expansion of the HE sector, which occurred in most European countries since the 1960s, has not benefitted students from all social strata (Kottmann *et al.*, 2019). Students from lower socio-economic backgrounds have remained largely under-represented and this has been increasingly seen as an obstacle to social mobility, as well as a waste of talent which harms the competitiveness of national economies. In the UK, the publication of the *Robbins report* in 1963 uncovered large inequalities in HE participation by students' socio-economic background and recommended the expansion of universities to be accompanied by widening

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participation to all people qualified by ability and attainment to pursue university studies (Committee on Higher Education, 1963). Since then, increasing efforts to widen access to HE have led to a series of policies at national and institutional level aimed at supporting entry and progression to HE for socially disadvantaged students. They include: outreach activities provided by HE institutions with the aim of encouraging young people from disadvantaged backgrounds to apply to university; policies directed to reduce the attainment gap in schools by increasing the number of eligible students for university admission; and the use of context-based admission criteria to take into account applicants' socio-economic and educational circumstances at the time of entering HE (Gorard *et al.*, 2019).

One of the limitations of the research evidence used to inform widening access policies in Scotland, our country of interest, is its reliance on the analysis of either aggregate data (at geographical and school level) or individual data which contains only limited information about the family of origin (e.g. data from university applicants concerning whether their parents have a HE qualification or not). This evidence is likely to underestimate the full extent to which family of origin matters for young people's chances of attaining higher levels of education and is limited in its ability to identify students who are most in need of support. Ours is the first study of Scotland which uses sibling data to estimate, in a more comprehensive way than before, the overall effect of family of origin and the relative importance of certain family characteristics (parental occupation, parental education and economic disadvantage) on young people's acquisition of HE qualifications. The aim is to provide new empirical evidence for understanding family inequalities and how they shape offsprings' chances of attaining HE, thus offering new theoretical and policy-relevant insights on the issue of social inequalities in HE.

Sibling designs are an important analytical strategy to capture the family environment because they provide a summary indicator of all measured and unmeasured characteristics shared by siblings at birth and during their upbringing (Björklund *et al.*, 2002; Conley & Glauber, 2008). This, in turn, allows us to assess the importance of shared family characteristics relative to individual, non-shared characteristics. Sibling correlations have also been used as an indicator of social mobility, with weak correlations indicating higher intergenerational mobility (i.e. less dependence on the family of origin) and stronger correlations being considered an indication of stronger family transmission of social (dis)advantage and thus of lower social mobility (Grätz *et al.*, 2019).

In this study we focus on sibling similarity in attaining HE qualifications. Higher education is considered one of the most important routes for social mobility, despite not being a sufficient condition for this to happen (Breen, 2010; Iannelli, 2011; Boliver, 2017). Thus, high levels of sibling similarity in the acquisition of a HE qualification would indicate a high level of societal closure and more limited possibilities of upward social mobility for children from more disadvantaged social classes. With some notable exceptions, there are very few studies examining sibling similarity in educational attainment in the UK (Sieben & de Graaf, 2001; Grätz *et al.*, 2019) and, to the best of our knowledge, no study has examined sibling similarity specifically focusing on the achievement of HE qualifications in Scotland, the wider UK or elsewhere. We aim to fill this gap with our study.

Besides examining the overall sibling correlations, this study investigates differences between subgroups, mainly defined by parental background characteristics. This allows us to assess whether family influence operates with the same strength across different social strata and to uncover possible differences in parental investment strategies which may explain inequalities in obtaining a HE qualification. Previous studies have found a stronger sibling similarity in outcomes among people from more privileged backgrounds than among people from less advantaged backgrounds (e.g. Conley & Glauber, 2008). Among the arguments put forward in the literature (Conley, 2008) is that socially advantaged families may employ 'compensatory' investment strategies, providing additional resources to the less academically successful child to improve their educational achievement, thus leading to higher sibling similarity than among less advantaged families. Conversely, less advantaged families may be more likely to employ a 'specialisation' strategy in which parents focus their limited resources on the education of their 'better-endowed' child, thus increasing within-family inequality. Our study examines whether sibling similarity differs depending on a range of parental background measures (i.e. parental education and occupation, and living in social housing). Moreover, it assesses the extent to which our measured parental background characteristics account for the total estimated family effect, comparing the relative importance of our main parental background indicators and their combined explanatory power. This is another unique contribution of the sibling design, since it allows us to analyse how well different measures of family (dis)advantage currently available in administrative and survey data can explain the family-of-origin effect on participation in HE.

Thus, in this article we ask the following questions: (1) What is the overall effect of family of origin on children's acquisition of a HE qualification (degrees and sub-degrees) compared to the effect of individual and other non-shared factors? (2) Does the importance of family background differ by social class of origin and by other family characteristics? (3) How much of the total variance between families is explained by parental social class, education and other family-level characteristics?

The Scottish context

In the last decades Scotland (and the rest of the UK) has witnessed an unprecedented expansion of HE. According to the most recent official statistics, in 2017/18, the Scottish HE Initial Participation Rate (HEIPR)[1] for those aged between 16 and 30 was 56.6% (Scottish Funding Council, 2019). During the period in which the siblings in this study achieved their HE qualifications (i.e. between the beginning of the 1980s and the first decade of the new millennium), the Age Participation Index[2] (precursor of the HEIPR) grew from 18.9 (1983/4) to 43.1 (2007/8) (Scottish Executive, 2006; Scottish Parliament Information Centre, 2010). This expansion has led to the inclusion of groups of the population who were under-represented in the past, including people from less advantaged social backgrounds. Despite this, research has documented the persistence of stark differences in overall HE participation between young people from working-class origins and young people from a professional/managerial class of origin (Iannelli *et al.*, 2011). Acquiring a degree remains a rather infrequent experience among the most socially disadvantaged students.

Moreover, the increase in the number of students from lower social backgrounds has been uneven within the HE system, with the highest growth occurring in newer universities and further education (FE) colleges (Iannelli *et al.*, 2011). Unlike England, the provision of sub-degree qualifications (mainly HNC and HND qualifications) in colleges is an important feature of the Scottish HE system, with about 21% of students attending HE in college in 2017/18 (Scottish Funding Council, 2019). Data covering the period from the 1990s to the first decade of the new millennium show that the share of undergraduate students in FE was 27% in 1990/91, 34% in 1999/2000 and 22% in 2006/7 (see table 1, p. 391 in Gallacher, 2009). The large provision of sub-degree courses in Scotland has facilitated access to HE for students from working-class origins. There are many reasons for this: entry requirements are lower than for universities (e.g. lower school grades and less relevance of prior subjects studied at school); the regional location of colleges makes them more accessible and less expensive than universities; their teaching provision is more flexible and able to accommodate different students' needs (e.g. provision of evening classes and part-time courses which allow students from less advantaged social backgrounds to combine work and study); and they offer flexible routes to enter university courses (via 'articulation') (Gallacher, 2009). Given the importance of sub-degree qualifications for widening access policies, our study will consider not only degree-level qualifications but also sub-degree-level qualifications.

Other national policies aimed to widen HE participation in Scotland have included the abolition of tuition fees;[3] the introduction of outcome agreements between the Scottish Funding Council and the HE institutions which established widening access targets to be met by universities and compelled them to introduce a series of initiatives (including contextualised admissions) to increase access rates of disadvantaged students; and interventions in schools to raise students' progression rates into HE (Iannelli, 2018). However, these policies aimed at widening access to HE and supporting the achievement of more equal outcomes between more and less advantaged social classes are mostly based on area-level indicators (e.g. the Scottish Index of Multiple Deprivation, SIMD). These indicators are inadequate, not least because they are unable to capture individuals who are disadvantaged due to their family circumstances but do not live in deprived areas. Paterson *et al.* (2019) estimated that only between one-third and one-half of the disadvantaged live in the 20% most deprived areas of the country. In a study on the contextual data used to identify disadvantaged students in the admission process in one Scottish university, Croxford *et al.* (2014) found clear mismatches between widening participation indicators based on geographical areas and schools and applicants' social class of origin, which led them to conclude that these aggregated data on their own cannot provide accurate information to facilitate entry to HE for applicants from lower social origins. This article aims to provide a more robust estimate of the importance of family circumstances for obtaining a HE qualification in Scotland and to investigate the extent to which family measures of parental social class, education and economic disadvantage can explain variations in the outcome analysed and could be useful to identify students in need of targeted policy interventions.

Theoretical framework

Sibling similarity: conceptual remarks and previous findings

Traditionally, the most common way of investigating the social reproduction of inequalities and the degree of openness of a society has been through the use of individual-level data to assess the degree of intergenerational mobility. Among sociologists the focus has been on the relationship between social class of origin and social class of destination (Erikson & Goldthorpe, 1992; Breen, 2004; Iannelli & Paterson, 2006), while economists have focused on intergenerational income mobility (e.g. Blanden *et al.*, 2004). However, another way of capturing the influence of family of origin and the transmission of social (dis)advantage across generations is to assess the correlation in outcomes among siblings living in the same families. Unlike approaches that focus on a specific indicator of family background (such as social class), sibling correlations measure the amount of variation in an outcome that is explained by all the characteristics that siblings share (whether we have explicitly measured them or not). These include genetic endowments, parental resources and parenting practices. Sibling correlations are thus often assumed to be an exhaustive measure of family origin effects; however, since they capture all common influences, not all of which may derive from the family of origin (such as neighbourhood or school effects), it is more accurate to say that they provide an upper bound measure of family background effects.

Studies based on sibling correlations are limited to families with more than one child and therefore, the substantive results from a sibling design cannot automatically be generalised to families with only one child.

Most of the studies assessing siblings' similarity in educational outcomes have focused on *years of education* attained (Table 1 provides key references and a summary of sibling correlations from these studies). Correlations vary depending on the context and the cohorts analysed, but they range broadly between 0.36 in Finland (Grätz *et al.*, 2019) and 0.60 in the USA (Mazumder, 2008). In the UK, less than half (0.42) of the variance in years of education achieved appears to be explained by family background (Grätz *et al.*, 2019). For Scotland, sibling correlations of about 0.58 and about 0.40 in the years of schooling were estimated for brothers born between 1916 and 1930 and between 1931 and 1975, respectively, indicating a reduction over time in the family-of-origin influence (Sieben & de Graaf, 2001).[4] Other studies have analysed sibling correlations in cognitive ability (Duncan *et al.*, 2001; Björklund & Jännti, 2012; Grätz, 2018; Grätz *et al.*, 2019) and in the exam results of children in primary and secondary schools (Rasbash *et al.*, 2010; Nicoletti & Rabe, 2013; Grätz *et al.*, 2019).

Our sample covers a more recent period than the study by Sieben & de Graaf (2001) (i.e. people born between 1961 and 1986) and it includes both brothers and sisters. Moreover, our outcome differs from previous research based on siblings, since we focus on HE qualifications, a particularly important outcome for widening access policies.

Differences in sibling similarity by parental background

Scholars have argued that sibling similarity can vary depending on social class of origin. In the economics literature this variation is explained by parents' investment

Table 1. Sibling correlations in educational outcomes estimated in previous studies

	Country	Sibling correlation	Authors
Years of education	Finland	0.36	Grätz *et al.* (2019)
	Scotland	0.40–0.44 (1931–1975) 0.58 (1916–1930)	Sieben and de Graaf (2001)
	Norway	0.40–0.42	Björklund and Salvanes (2011); Grätz *et al.* (2019)
	Sweden	0.44	Björklund and Jännti (2012); Grätz *et al.* (2019)
	UK	0.42	Grätz *et al.* (2019)
	USA	0.50–0.51	Hauser and Mossel (1985); Grätz *et al.* (2019)
	USA	0.60	Mazumder (2008)
	Germany	0.51	Grätz *et al.* (2019)
	Germany	0.66 brothers; 0.55 sisters	Schnitzlein (2014)
	Australia	0.51	Marks and Mooi-Reci (2016)
	Multiple countries: England, Hungary, The Netherlands, Scotland, Spain and the USA	Overall, 0.52	Sieben and de Graaf (2001)
School attainment	USA	0.42	Grätz *et al.* (2019)
	UK	0.44–0.54 (end of primary school) 0.47–0.61 (end of compulsory school)	Nicoletti and Rabe (2013)
	UK	0.40 twins (after estimating separate neighbourhood, school and Local Education Authority variance components)	Rasbash *et al.* (2010)
	Norway	0.48	Grätz *et al.* (2019)
	Sweden	0.52	Grätz *et al.* (2019)
Cognitive ability	Germany	0.42	Grätz (2018)
	Germany	0.46	Grätz *et al.* (2019)
	Norway	0.45	Grätz *et al.* (2019)
	Sweden	0.47 brothers	Björklund and Jännti (2012)
	USA	0.57	Grätz *et al.* (2019)
	USA	0.46 boys 0.56 girls (full non-twin siblings) 0.64 dizygotic twins 0.78 monozygotic twins	Duncan *et al.* (2001)

strategies, given their children's endowments and the resources available. Becker and Tomes (1976) theorised that parents from more advantaged backgrounds tend to invest more in the human capital of the better-endowed child, hence reinforcing their

talents, and subsequently compensate the less talented children by investing more non-human capital to ensure the inheritance of their social advantage. This would lead to a lower degree of sibling similarity in education among the more privileged families than among the less privileged. In contrast, less privileged families will be unable to invest in their children to anything like the same extent, regardless of their children's abilities, leading to higher sibling similarity compared to their peers from higher socio-economic backgrounds.

A counter-argument is that families with fewer resources might find it more efficient to invest in the child who promises the greatest returns on investment (Behrman *et al.*, 1982). Such a 'specialisation' strategy could be motivated by the higher perceived chances of success of the more talented offspring and by the hope that the family will benefit directly from the future gains of the successful offspring via wealth transfers, including transfers towards the less-endowed sibling (Conley, 2008). Hence, this strategy could lead to lower sibling similarity among the lower socio-economic groups. In contrast, more advantaged families could invest more in the offspring who shows more weakness, in an attempt to equalise the outcomes of all offspring 'as if equality is a luxury good that only better off families have the means to purchase' (Conley, 2008, p. 189). As a consequence, this 'compensatory strategy' is likely to result in more similarity among siblings (i.e. higher correlations) from higher social strata.

However, there are other reasons to expect a higher level of sibling similarity among those from higher socio-economic backgrounds, even when all siblings have the same level of endowment. Siblings from higher social classes are likely to face a stronger pressure and level of support to achieve higher levels of education in order to avoid downward mobility. The *relative risk aversion* mechanism highlighted by Breen and Goldthorpe (1997) emphasises that all families will try to maximise the chances of their children at least maintaining their social class of origin, or better, of reaching a higher social class. This implies that, in order to preserve their social position, more advantaged social classes will have a stronger interest in continuing in education than will less advantaged classes.

Differences in sibling correlations according to socio-economic background could also be rooted in parental practices during children's early years. Research has shown that middle-class families pursue more strict, planned and intentional parenting practices, defined by Lareau as 'concerted cultivation', while working-class families tend to follow a more *laissez-faire* parenting style, referred to as 'natural growth' (Lareau, 2003). It is plausible to expect that the 'concerted cultivation' strategy is likely to result in more similar outcomes across siblings compared to the 'natural growth' strategy.

Previous studies provided mixed evidence regarding the extent to which sibling similarity in educational outcomes differs by parental background, with some results supporting the existence of differences (e.g. Conley *et al.*, 2007; Conley & Glauber, 2008; Grätz *et al.*, 2019) while others do not (e.g. Conley, 2008; Grätz, 2018). In the USA, scholars have found evidence for lower sibling similarity in the attained years of education among larger families and those with low income, but no difference by maternal education (Conley & Glauber, 2008). Also, children from single-parent families showed less resemblance in earlier cognitive ability than children in two-parent families (Conley *et al.*, 2007). However, some results also indicated an opposite pattern, that is, higher similarity among the more disadvantaged families (Conley

et al., 2007; Grätz *et al.*, 2019). Conley *et al.* (2007) found that siblings whose mother did not attain HE displayed higher correlations on letter–word identification. Comparing several countries, Grätz *et al.* (2019) also found slightly higher resemblance among siblings from disadvantaged backgrounds (i.e. measured by father's education, mother's education and parental occupation) in Norway and Finland, but they did not find systematic differences in the other countries they examined (Germany, the UK, Sweden and the USA). In addition, Grätz and Torche (2016), focusing on early cognitive performance among US twins, found that parents with higher socio-economic status tend to provide more cognitive stimulation to the higher-ability child, while parents with lower socio-economic status do not behave differently according to differences in their children's ability.

As mentioned before, one of the strengths of using sibling data is the possibility to investigate how much of the family effect can be accounted for by measured family background characteristics (e.g. parental education, occupation, family size). Studies vary in the extent to which the available family measures could explain the shared family influences on siblings' outcomes. For example, in an Australian study, based on cohorts covering most of the twentieth century, about 30% of the total family effect was explained by father's socio-economic index, parents' education, books in the home and wealth (Marks & Mooi-Reci, 2016). Other studies found a higher share (Hauser & Featherman, 1976; Hauser & Sewell, 1986; de Graaf & Huinink, 1992; Toka & Dronkers, 1996; Sieben & de Graaf, 2001), varying from 45% in a pooled cross-national sample from England, Scotland, Hungary, The Netherlands, Spain and the USA (Sieben & de Graaf, 2001) to 58% in West Germany (de Graaf & Huinink, 1992), depending on the context and the family variables included in the study. Some studies (Kuo & Hauser, 1995; Marks & Mooi-Reci, 2016) found a tendency for a decrease across cohorts in the amount explained by measured characteristics and an increase in the importance of unmeasured factors.

Data and methods

Data

This study uses data from the Scottish Longitudinal Study (SLS), a large-scale linkage study created using administrative and statistical data including census data from 1991 to 2011. The SLS contains information on 5.3% of the Scottish population who were selected using 20 semi-random birth dates. Our sample (N = 2,150) consisted of pairs of siblings among the SLS members who were aged between 25 and 50 at the 2011 Census and lived in the same household at the 1991 Census. To avoid major differences in family circumstances which may have affected siblings, we only retained sibling pairs which were spaced no more than 6 years apart (N = 1,075 sibling pairs). When more than two siblings were in the sample, we kept the two which were closest in age.

Variables

Our outcome consisted of a binary variable indicating whether siblings attained a higher education qualification or not by the 2011 Census. We analysed two

outcomes: whether they obtained a university degree and whether they obtained a HE qualification, defined as either a university degree or a sub-degree comprising 1- and 2-year HE qualifications, mainly provided in FE colleges. We use respondents' highest level of education attained, therefore, with degree and sub-degree qualifications being two mutually exclusive categories (if someone in the sample obtained a degree after having gained a sub-degree qualification, they were included among the degree holders). This latter definition was used to account for the broader HE landscape in Scotland and the increasing importance of FE colleges as providers of HE for less socially advantaged groups. We distinguish siblings from more or less socially advantaged families through information on parental social class, parental education and housing tenure, which was collected in 1991 when siblings were living in the parental home.[5] Family background effects are made up of different kinds of resources that families possess and can invest in their children, and these resources are often categorised as economic, social and cultural (see e.g. Bowles & Gintis, 2002). With our three main predictor variables, we try to capture all three types of resources: social resources through parental class, cultural resources through parental education and economic resources through housing tenure.[6] We measured parental social class using the NS-SEC three-class schema (Rose *et al.*, 2005) with the inclusion of a fourth category for parents who were not in employment: (1) managerial and professional; (2) intermediate; (3) routine and manual; (4) never worked or long-term unemployed. Parental education distinguished whether either of the parents had HE or not. Degrees and sub-degrees were combined into the category 'higher education' due to the smaller percentage of parents with first degrees or above. The third parental background variable 'housing tenure' indicated whether siblings and their parents lived in social housing or not and it is used as a proxy for economic disadvantage. The SLS data do not contain information on family income, which has been found to be an important factor in predicting young people's university participation (Blanden & Machin, 2004; Anders, 2012). However, previous research based on the SLS data has shown that 'living in social housing' has a negative effect on school leavers' destinations over and above parental education and social class (Iannelli & Duta, 2018), thus suggesting that this indicator is able to capture some of the economic disadvantage experienced by the sample members.

In addition, we also controlled for gender, age and whether or not the siblings were twins (the SLS data do not provide information about whether twins are monozygotic or dizygotic).

Methods

Given the structure of our data, namely individuals i (Level 1) nested in sibling dyads/families j (Level 2), we modelled our outcome (i.e. probability of attaining HE), Y_{ij}, using random intercept effects/multilevel models, both binary logistic and linear probability models (LPM). These models were fitted with Stata's *melogit* and *mixed* commands using restricted maximum likelihood (REML) estimation for the latter models. The general empty model can be expressed as follows:

$$Y_{ij} = \gamma_{00} + U_{0j} + R_{ij} \tag{1}$$

where the dependent variable is the sum of a general mean γ_{00}, a random effect at the family level U_{0j} and a random effect at the individual level R_{ij} (Snijders & Boskers, 2012).

The key random effects statistics in our analysis are the family-level variance (i.e. between families) τ_0^2 and the individual-level variance (i.e. within families/between siblings) σ^2. It is worth noting that this latter statistic is only provided by the linear probability model, while in the logistic regression it is unknown but fixed, conventionally, to equal the variance of a standard logistic distribution, $\pi^2/3 = 3.29$. The intraclass correlation coefficient (ICC) ρ is defined as the ratio of the between variance to the total variance:

$$\rho = \frac{\tau_0^2}{\tau_0^2 + \sigma^2} \tag{2}$$

The ICC measures the correlation between two randomly drawn siblings in one randomly drawn family and is thus an indicator of siblings' similarity. It tells us how much of the variation in an outcome lies between families, rather than within them. The larger this is (the larger the correlation between siblings), the greater is the influence of family background on the outcome.

However, besides the estimates obtained from the statistical models, we also generated some key descriptive statistics (drawing on Breen & Ermisch, 2021), which help to interpret our results. First, q represents the proportion of families in which both siblings have the same outcome (HE or not). Second, s indicates the proportion, among those families in which both siblings have the same outcome, of families in which both siblings attain HE. Breen and Ermisch (2021) show that the probability that $Y = 1$ can be written

$$p(Y_{ij} = 1) = \frac{1}{2} + q\left(s - \frac{1}{2}\right) \tag{3}$$

with the standard error for q given by

$$se(q) = \sqrt{\frac{q(1-q)}{N}} \tag{4}$$

and similarly for $se(s)$. The within variance is equal to $(1-q)/2$.

We use these statistics, alongside the ICC, to analyse sibling similarity across our subgroups under investigation. This is because, as Breen and Ermisch (2021) demonstrate, when the outcome under consideration is binary, the ICC estimates for subgroups will depend not only on the within-family variation but also on the mean probability of the outcome. This makes comparisons of the ICC across groups problematic. To see this, they rewrite the ICC for a binary outcome in terms of q:

$$1 - \frac{1-q}{2p(1-p)} \tag{5}$$

The variance of a binary outcome (used in the denominator of Equation (5)) depends on p and thus the ICC does too. When p is close to 0.5, the ICC will be large, and when it is closer to 0 or 1, the ICC will be small. Consequently, when analysing groups (e.g. social classes), their ICCs can differ because the values of p for the groups are different or because the within-family variation (captured by q) differs, or both. In such circumstances, focusing on the within-group variance itself, or on q (since $1-q$ equals twice the within-group variance), is more suitable than the ICC in telling us if different groups display more or less heterogeneity of outcomes among siblings within the same family.

Results

Some descriptive statistics

Our sample is equally split between men and women, and the majority of siblings were aged 34 years or less at the time of the 2011 Census (Table S1). 48% of siblings came from less advantaged families where parents had lower occupations or were long-term unemployed, while 30% of them originated from parents with managerial or professional occupations. Among the other family characteristics, 32% of siblings lived in social housing, 12% were from a lone-parent family and only 21% had parents with a HE qualification. Regarding sibling-pair composition, 56% were of the same sex, with 19% of these being same-sex twins. Most siblings were born 2 years apart or less.

In our data, 33% of the sibling sample achieved a degree-level qualification while another 14% obtained a sub-degree-level qualification. We start our analysis by looking at the extent of variation between and within families with respect to their chances of (1) achieving a degree and (2) achieving a HE qualification including sub-degree-level qualifications. Then, subgroup differences are analysed further.

Statistical modelling

To examine the share of between- and within-family variance in siblings' chances of obtaining a university degree, we run the random effects LPM and the random effects logit model. The estimated ICC indicating sibling similarity in obtaining a degree is 0.39 when using the LPM (Table 2) and 0.56 in the logistic estimation (the pattern of a larger ICC in the logistic models is found in all our analyses). Given that the logistic regression has a fixed individual-level variance, which influences the calculation of the ICC, we focus on the ICC from the LPM, which Breen and Ermisch (2021) show is a non-parametric estimator of the ICC (all the results of the logistic regression analyses are presented in Tables S4 and S5). Therefore, according to the ICC of the LPM, about 40% of the variation in the probability of acquiring a university degree lies between families. This is very close to the sibling correlation of 0.42 for overall educational attainment in the UK reported by Grätz *et al.* (2019), who used data from the 'Understanding Society' survey, and that of about 0.40 found by Sieben and de Graaf (2001) in the more recent cohorts of the Scottish Mobility Study

Table 2. Random effects linear probability models predicting probability of attaining a degree

	1	2	3	4	5	6
Gender (ref.: male)						
Female		0.0759***	0.0766***	0.0761***	0.0794***	0.0790***
		(0.0191)	(0.0184)	(0.0185)	(0.0187)	(0.0181)
Age group (ref.: 25–29)						
30–34		0.0128	0.00795	−0.000678	0.00317	−0.00238
		(0.0266)	(0.0253)	(0.0255)	(0.0260)	(0.0248)
35–39		−0.0106	−0.0134	−0.0268	−0.0240	−0.0279
		(0.0297)	(0.0277)	(0.0280)	(0.0287)	(0.0270)
40–44		−0.0827*	−0.0628	−0.0708*	−0.0903**	−0.0656*
		(0.0354)	(0.0330)	(0.0333)	(0.0342)	(0.0321)
45–50		−0.139*	−0.0852	−0.0933	−0.130*	−0.0736
		(0.0586)	(0.0551)	(0.0556)	(0.0568)	(0.0537)
Twins (ref.: no)						
Yes		0.0538*	0.0426	0.0481	0.0533*	0.0427
		(0.0269)	(0.0244)	(0.0247)	(0.0256)	(0.0234)
Parental higher education (HE) (ref.: yes)						
No HE qualifications			−0.406***			−0.279***
			(0.0265)			(0.0304)
Parental social class (ref.: managerial professional occupations)						
Long-term unemployed				−0.396***		−0.175***
				(0.0428)		(0.0460)
Lower occupations				−0.353***		−0.169***
				(0.0261)		(0.0300)
Intermediate occupations				−0.180***		−0.0514
				(0.0305)		(0.0316)
Council housing (ref.: no)						
Yes					−0.257***	−0.120***
					(0.0241)	(0.0250)
Constant	0.329***	0.292***	0.614***	0.510***	0.380***	0.650***
	(0.0119)	(0.0249)	(0.0312)	(0.0289)	(0.0254)	(0.0309)
Level 2 variance	0.085	0.082	0.056	0.058	0.068	0.046
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)
Level 1 variance	0.135	0.135	0.135	0.135	0.135	0.135
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ICC	**0.387**	**0.379**	**0.293**	**0.302**	**0.335**	**0.255**
	(0.026)	(0.026)	(0.028)	(0.028)	(0.027)	(0.029)

Source: SLS; standard errors in parentheses.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

dataset. When using the broader definition of HE, which combines degrees and sub-degrees, the family effect is slightly weaker, with an ICC of 0.35 (Table 3).

The second part of our analysis focuses on within- and between-family variation among sibling pairs from various social backgrounds. As mentioned in the Methods section, we use q and s statistics to assess group differences in sibling similarity. The results presented in Figure 1 show that q (i.e. the proportion of siblings who achieved

Table 3. Random effects linear probability models predicting probability of attaining HE (degree and sub-degree)

	1	2	3	4	5	6
Gender (ref.: male)						
Female		0.0832***	0.0828***	0.0833***	0.0860***	0.0852***
		(0.0205)	(0.0199)	(0.0198)	(0.0202)	(0.0196)
Age group (ref.: 25–29)						
30–34		0.0336	0.0298	0.0205	0.0248	0.0198
		(0.0284)	(0.0274)	(0.0272)	(0.0279)	(0.0268)
35–39		0.0119	0.00954	−0.00390	−0.000753	−0.00388
		(0.0315)	(0.0299)	(0.0298)	(0.0307)	(0.0291)
40–44		−0.0708	−0.0539	−0.0594	−0.0787*	−0.0547
		(0.0375)	(0.0356)	(0.0354)	(0.0365)	(0.0346)
45–50		−0.205**	−0.150*	−0.148*	−0.194**	−0.128*
		(0.0623)	(0.0595)	(0.0592)	(0.0607)	(0.0580)
Twins (ref.: no)						
Yes		0.0654*	0.0554*	0.0602*	0.0650*	0.0556*
		(0.0282)	(0.0262)	(0.0260)	(0.0271)	(0.0252)
Parental higher education (HE) (ref.: yes)						
No HE qualifications			−0.370***			−0.240***
			(0.0285)			(0.0326)
Parental social class (ref.: managerial professional occupations)						
Long-term unemployed				−0.427***		−0.245***
				(0.0451)		(0.0495)
Lower occupations				−0.344***		−0.191***
				(0.0276)		(0.0323)
Intermediate occupations				−0.144***		−0.0345
				(0.0321)		(0.0340)
Council housing (ref.: no)						
Yes					−0.240***	−0.0919***
					(0.0255)	(0.0269)
Constant	0.473***	0.419***	0.713***	0.628***	0.501***	0.747***
	(0.0125)	(0.0264)	(0.0336)	(0.0306)	(0.0271)	(0.0332)
Level 2 variance	0.088	0.084	0.062	0.060	0.072	0.051
	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Level 1 variance	0.162	0.160	0.160	0.160	0.160	0.160
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ICC	**0.351**	**0.345**	**0.280**	**0.271**	**0.309**	**0.242**
	(0.027)	(0.027)	(0.028)	(0.028)	(0.028)	(0.029)

Source: SLS; standard errors in parentheses.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

the same educational outcome) is very high for all social groups, indicating that, in most cases, siblings have very similar educational outcomes. However, very large differences in *s* [i.e. the proportion of siblings, among those who achieved the same outcome, who obtained a degree (Figure 1) or a HE qualification in a broader sense (Figure 2)] emerge by parental background.

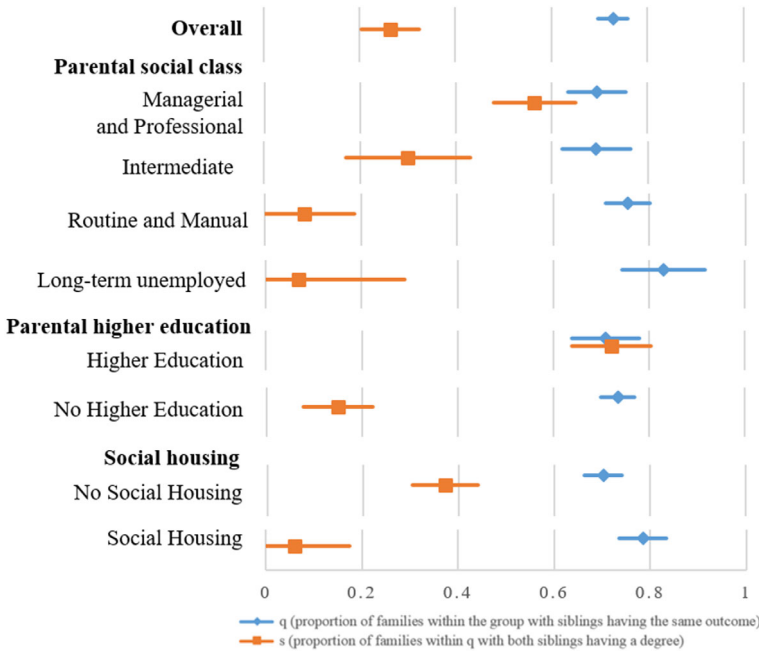

Figure 1. Proportion of sibling pairs having achieved the same outcome (*q*) and proportion of sibling pairs, among those who achieved the same outcome, who obtained a degree (*s*) by parental social class, higher education and council housing (outcome: university degree).
Source: SLS.
Note: 95% confidence intervals. [Colour figure can be viewed at wileyonlinelibrary.com]

Thus, for siblings whose parents were in long-term unemployment or routine and manual occupations, there is a far lower chance of both of them obtaining a university degree (7–8%) than for siblings whose parents had managerial and professional occupations (56%). These patterns are confirmed, even though the percentages are higher (15%, 24% and 76%, respectively), when using our broader definition of HE (see Tables S2 and S3 for the data behind the figures). Similarly, only 6% of siblings who lived in social housing with their parents both obtained a university degree, compared to 38% of sibling pairs who did not live in social housing. Sharp differences are also visible when looking at parental education. Only 15% of siblings whose parents had no HE both obtained a university degree, versus 72% of those whose parents achieved HE. As in the case of social class, the proportion of siblings obtaining HE qualifications was higher when combining degrees and sub-degrees, but significant differences remain. These figures highlight that the extent of inequalities is even more salient when considering the family as unit of analysis instead of individuals.

Moreover, they indicate that different reasons are behind the high degree of siblings' similarity (measured by *q*) in the educational outcomes analysed among people from different social origins. The fact that siblings' similarity is high among children from more disadvantaged families is because the chances of both of them not achieving a HE qualification are very high; on the contrary, the high degree of similarity among siblings from more advantaged families is driven by their high probability of achieving a HE qualification. This suggests that, in this latter group, parents may use

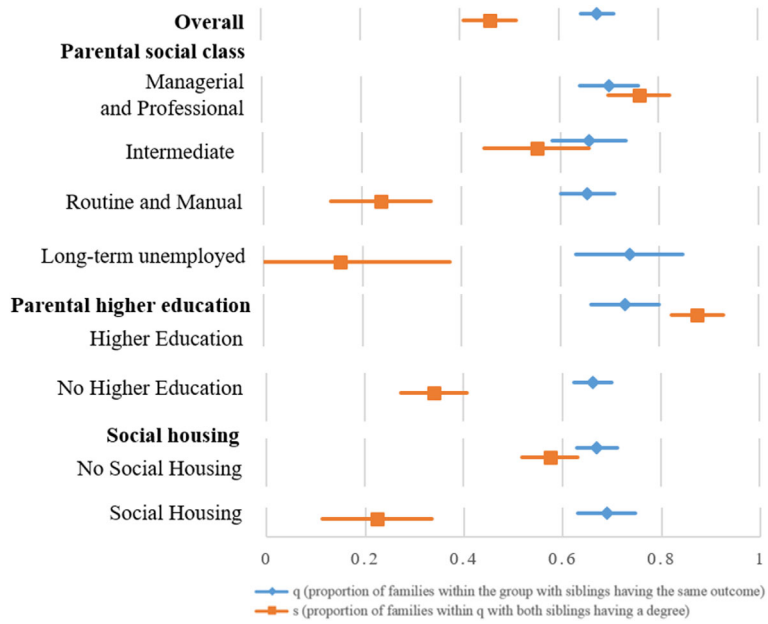

Figure 2. Proportion of sibling pairs having achieved the same outcome (*q*) and proportion of sibling pairs, among those who achieved the same outcome, who obtained a degree/sub-degree (*s*) by parental social class, higher education and council housing (outcome: degree/sub-degree). Source: SLS.
Note: 95% confidence intervals. [Colour figure can be viewed at wileyonlinelibrary.com]

compensatory strategies or a more structured parenting style (e.g. concerted cultivation) to ensure that both their children will acquire a HE qualification, thus maintaining their family advantages and avoiding downward mobility. In the former case, instead, parents and their children are likely to be driven in their decisions by economic constraints, which, in the great majority of such families, leads to neither sibling attaining HE (and, for a small share of them, only one child attaining HE).

The issue of economic disadvantage is somewhat alleviated, but far from solved, by the provision of sub-degree-level courses in the FE sector. When considering HE in its entirety, the social class gap continues to be particularly stark because children from more advantaged families also benefit from this provision. Indeed, when considering degrees and sub-degrees, about three-quarters of children with parents in professional and managerial occupations, and almost 90% of children of HE graduates, have acquired a HE qualification. The children from intermediate social classes lie between these two.

Factors explaining between-family variation

Another unique insight that sibling designs can offer is establishing how much of the total variance between families is explained by measured parental background characteristics (in our case these are parental education, social class and living in social rented housing). Based on the LPM ICCs of the two outcomes considered in our

study (i.e. achieving a university degree and having obtained a HE qualification more broadly; Tables 2 and 3), parental education alone explains about 23% and 19%, respectively, of the total variance between families (Model 3). Parental social class explains about 20–21% of the between-family variance (Model 4) and lastly, social housing explains 10–12% (Model 5). Together, these three factors (Model 6) account for about a third of the between-family variance in obtaining a university degree and slightly under a third (30%) when considering HE more broadly as outcome. However, about two-thirds of the variance remained unexplained, even when we included additional explanatory variables at the family level—such as single parenthood, parental illness and living in more or less deprived areas.[7]

Our statistical models also allow us to quantify the effect of the three parental characteristics on their siblings' HE qualifications by providing more robust estimates of these effects. The results indicate that the chance of obtaining a university degree for individuals whose parents had no HE was 41 percentage points lower compared to those whose parents attained HE. The gap is slightly lower (37 percentage points) when considering HE as an outcome. Regarding social class, the chance of achieving a university degree/HE qualification for those children whose parents were in long-term unemployment was between 40 and 43 percentage points lower than for those whose parents were in the top social classes. The same chances were about 34 to 35 percentage points lower for those coming from routine and manual social classes, and between 14 and 18 percentage points lower for those from intermediate social classes. Lastly, a smaller but significant gap (24 to 26 percentage points) was found between those who lived in social housing and those who did not. When including all three factors together, each background factor remains statistically significant but, as mentioned above, substantive differences remain unexplained. This indicates that other family characteristics, for which we do not have information in the data, play an additional role in affecting the chance of attaining HE. These may include shared genetic factors and any other family aspects which are not entirely captured by our measured family background variables (e.g. parent–child relationship including conflict and closeness, parental separation during key school transitions, etc.).

Our focus has been on differences between families (sibling pairs) as an indicator of social openness, but there is also variation in educational outcomes between siblings in the same family. One source of this variation is the possibility that factors affecting both siblings might nevertheless affect them in different ways. Another is differences between siblings themselves. Siblings differ in birth weight, which is known to affect many adult outcomes, and in their genetic endowment (unless they are identical twins), and they have many non-shared experiences when growing up—they may not attend the same school, for example, they might have different peers, and so on. Also, one sibling might influence the other (as in Nicoletti & Rabe, 2019) and if this influence were negative, it would lead to larger differences between siblings. A thorough investigation of all these kinds of factors would require an extensive set of individual-level covariates, but our data contains only a limited number of them. Among these, women were found to be more likely—and the older sample members less likely—to achieve a degree/HE qualification. Both patterns can be explained by the educational expansion of the last decades, which has led to higher numbers of women and young people entering

and acquiring a HE qualification in Scotland. Twins were also found to be more likely to graduate from HE than other siblings. This positive association was not statistically significant for attaining a university degree after controlling for parental education or social class. However, it remained statistically significant, regardless of the other factors, when considering the broader HE definition. Previous research in the UK also found that twins tend to attain slightly more years of schooling than the general population (e.g. Blanchflower & Elias, 1999; Bonjour *et al.*, 2003), but the reason why this is the case remains unclear, given that there is no evidence of higher ability among twins compared to non-twins (Calvin *et al.*, 2009).

Conclusions

This study aimed to contribute new evidence about the extent to which family of origin matters for the acquisition of a HE qualification in Scotland, a country which has put widening access to HE at the core of its educational policies. It used a novel approach to inform this issue by exploiting linked sibling data from the SLS, provided estimates of the overall effect of family of origin on children's chances of obtaining a HE qualification and assessed whether sibling similarities in these chances depend on a range of parental background characteristics. We found that about 40% of the variation in siblings' chances of obtaining a HE qualification is due to family of origin (and other unobserved shared factors, such as neighbourhood or school effects). Moreover, we also found that the degree of similarity among Scottish siblings in their HE outcomes does not differ between those from more or less advantaged backgrounds. This is clear from Figure 1 and even more evident in Figure 2, both of which show little variation in q across different social origin groups.

Nevertheless, similarity in HE outcomes within families is found alongside large differences between families in how that similarity comes about. Siblings of advantaged families are alike because they both have a degree, while siblings from disadvantaged families are alike because neither of them has a degree. The proportion of families in which siblings have different educational outcomes (i.e. $1-q$) is around 20%, and this does not differ according to social background. Families in which one child acquires a degree and the other does not are, therefore, rather unusual. This leads us to conclude that economic disadvantage is the driving force behind the patterns found among the disadvantaged families, while compensation strategies are more likely to operate in more advantaged families. That the economic argument is the most plausible explanation for the patterns found among siblings from working-class families is confirmed by the results from some further investigations of the data, which showed that siblings in families where parents were long-term unemployed or in routine and manual jobs are twice as likely as siblings from the same background to both have a degree if they lived in a two-parent family and did not live in social housing.

To what extent do parental social class, parental education and living in social housing account for between-family variation in siblings' outcomes? Our analyses show that they explain roughly one-third of this when considering a university degree as an outcome and a little less than this when focusing on a broader

definition of HE that includes FE colleges. These three background characteristics are all significant predictors when they are considered individually and each continues to play a role, and remains statistically significant, when we control for the others. So, for example, if we focus on the manual working class, children in that class who have less educated parents or who live in social housing do less well than those with more educated parents or whose parents did not live in social housing. These findings have implications for policies aimed at widening participation in HE. They highlight that the contextual data used by universities for HE admission needs to take into account multiple information about applicants' economic, social and cultural resources. Moreover, the striking finding that in a large majority of disadvantaged families no child enters HE demonstrates that these families are not in a position to support their children's post-school education, suggesting a need for policies which target families in addition to individual students. The strong commitment of the Scottish government to provide free tuition to all students, irrespective of their social background, has not produced the expected reduction in inequality of access to HE. This is because it has not completely eliminated the economic burden of attending HE for poor students (in terms of the opportunity cost of earning loss and maintenance costs). Maintenance grants for disadvantaged students are limited, and the imposition of a cap in student numbers has reduced universities' capacity to expand to accommodate the new applicants and has increased student competition.

Perhaps surprisingly, we also found that social inequalities in achieving a HE qualification are not diminished if we analyse degrees and sub-degrees together (our second outcome). Despite the current widening access policies aimed at equalising educational opportunities by expanding the FE sector, our results show that social background differences are either no different (e.g. in relation to the 'social housing' indicator) or slightly larger (e.g. when comparing the bottom and top social classes) for attainment of HE qualifications when including both degree and sub-degree than for attainment of a degree alone. This is clear if we compare the values for *s* plotted in Figure 1 with those in Figure 2, or the coefficients reported in Table 2 with those in Table 3. Contrary to what we might have expected, it seems that the expansion of HE qualifications in the FE colleges has benefitted children from both more and less advantaged backgrounds. Far from reducing educational differences according to social background, FE has increased opportunities for children from all social classes of origin, thus maintaining existing societal and educational disparities. This result suggests that expanding the FE route is not enough to equalise participation in HE and increase social mobility.

In conclusion, the results presented show that the extent of social inequalities in HE is even more marked when analysing sibling data than when analysing individual-level data. This is because we were able to capture the full influence of family of origin and thus account for unobserved shared factors. In addition, we found that our three measures of parental background explain only about a third of the total variance at family level. This suggests that, on the one hand, studies using only a few observable characteristics may underestimate the role that parental background plays in influencing individuals' life chances and, on the other hand, we need to collect and analyse more nuanced data, which will allow us to disentangle the effect of other shared

factors such as genetic endowments, parental resources and practices, and also to investigate non-shared factors which explain differences among siblings. Despite providing many new opportunities for research in this area, administrative data is limited in the amount of information it provides. Thus, linking administrative data to social survey data (in particular longitudinal data), or strengthening the sibling data in current household panel studies, seems to be the best avenue to gain access to richer information and to achieve a deeper understanding of the mechanisms behind the patterns found.

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NOTES

[1] HEIPR aims to estimate the probability that a 16-year-old will participate in HE by the age of 30. An initial entrant is defined as any student who participates for at least 6 months on a course which is expected to last for at least 6 months and who has not participated in HE previously for a period of at least 6 months (at a college or HE institution) (Scottish Funding Council, 2019).

[2] The Scottish Age Participation Index (API) for a given year is defined as the number of young Scots aged under 21 who enter a full-time HE course for the first time in that year, taken as a percentage of the population of 17-year-olds at 31 December in the same year (Scottish Executive, 2006).

[3] During the time in which our siblings attended HE, HE was either free or required a small financial contribution. Between the 1960s and the 1990s, students in UK HE institutions did not pay tuition fees and the state offered maintenance grants to many students. In 1998–99, a means-tested fee payment of up to £1,000 was introduced across the UK but this payment was abolished in 2000–2001 for Scottish students studying in Scotland. In 2001–2002 a post-graduation payment of £2,000 (the 'graduate endowment') was introduced in Scotland, which was abolished in 2006–2007. Since then, no Scottish students in Scottish universities pay tuition fees (Hunter Blackburn *et al.*, 2016).

[4] This decline was also found in previous work carried out by Iannelli and Paterson (2006), which showed that in Scotland, between the beginning and the second half of the twentieth-century, the association between social class of origin and social class of destination weakened, aligning the originally lower Scottish levels of social mobility with the levels found in England.

[5] Most of the siblings in our sample (96%) were 24 years or younger when living in the parental home, with the rest (4%) being between ages 25 and 30.

[6] Furthermore, parental education and class are widely used to gauge equality of opportunity in studies of education and social mobility.

[7] These additional parental background variables were not statistically significantly associated with attaining HE net of parental social class, education and living in social rented housing, except for area of deprivation, which remained statistically significant, particularly for the gap between top and bottom Carstair score quintiles.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Supplementary Material